



Activities at Rocky Mountain Geographic Science Center

Carol Mladinich

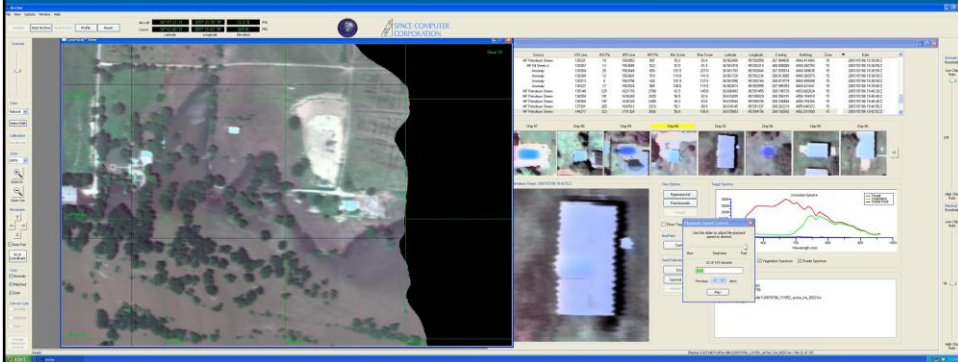
Rocky Mountain Geographic Science Center

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U.S. Department of the Interior
U.S. Geological Survey

Real-time Processing Tools

- GeoPaint®
- GeoView™
- Signature Match Detection
- Anomaly Detection



GeoPaint® –rapid visualization GUI that displays geo-registered HSI data on a UTM grid and overlays detected targets at their actual ground coordinates, all in real time.

GeoView™ – graphical user interface for rapid evaluation of targets

Signature Match Detection – algorithm detects spectra that match a predetermined spectrum, logarithmic scale

Anomaly Detection –algorithm detects spectra that are anomalous to general background, sensitivity based threshold

RMGSC Off-line Processing Tools

- GeoSharpen™
- GeoReg™



SCC has also developed off-line tools that perform specialized processing of HSI and panchromatic data. Some of these tools are designed to run in batch mode, freeing the user while the large amounts of data are processed into visual images, while other tools are more useful in a continuous data playback environment.

GeoSharpen™ – batch mode processor; converts raw HSI data into high-resolution geo-registered survey imagery.

GeoReg™ – batch mode processor; geo-registers HSI or panchromatic data and displays results as viewable imagery.

GeoChange™ – data stream processor; algorithm that co-registers overlapping HSI datasets and performs pixel-level spectral difference evaluation to detect changes between the datasets.

Chip on Demand™ – algorithm that creates target for user-selected pixel.

Coffeyville, KS Flood/Oil Spill

"A malfunction allowed the oil to spill from the Coffeyville Resources refinery on Sunday, while the plant was shutting down in advance of the flood heading toward it on the Verdigris River." [June 30, 2007]



Coffeyville flooding 7/3/2007



Coffeyville flooding - refinery 7/3/2007

"The flood engulfing homes to the rooftops carried an extra curse Tuesday as a slick of 42,000 gallons of thick crude oil floated downstream with the mud and debris, coating everything it touched with a slimy, smelly layer of goo."



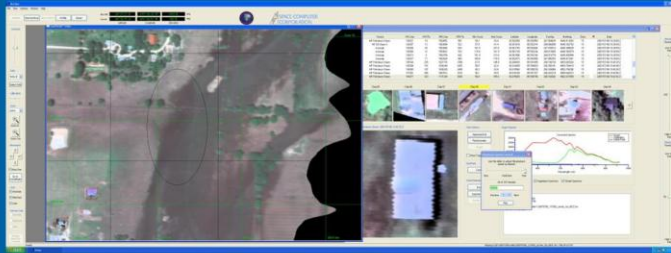
Roxana Hegeman, AP, July 3, 2007

Setting the stage.....end of June was a wet one for many of the southern Great Plains states in 2007. RMGSC was asked by EPA Region 6 about any capability to fly the flooded area to detect the extent of the oil spill from the Coffeyville refinery. The USGS liaison with NorthCom was brought into assist in mobilizing the Civil Air Patrol and their ARCHER system. The request and authorization was completed and the CAP MO Wing notified in an afternoon's time. The Wing attempted to fly on July 4 but weather did not cooperate. The area was completely flown on July 5th and 6th. The current ARCHER processing software was not commercially available at that time. Space Computer Corporation made beta releases of the GeoReg and GeoReplay software available to process the data with. The data took approximately a week to get copied off onto an external hard drive and delivered to RMGSC for processing. In all the data was processed into 4-band image files and delivered to the Kansas Emergency Center and EPA Region 6 by July 25. The GeoSharpen software now available could cut this time down to hours rather than days.

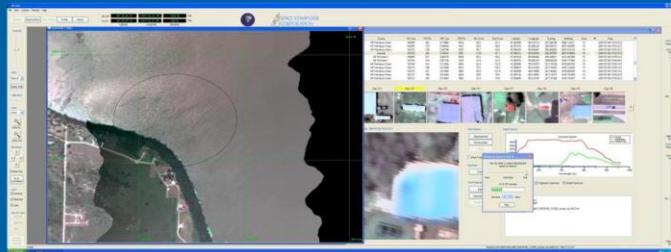


SE Kansas, southern city limits on KS-OK state line, 30 mi NE Tulsa

Flood debris and oil flowing down Verdigris River towards Lake Oologah, drinking water for several cities including Tulsa



Possible oil contamination



Screen shots received from CAP crew

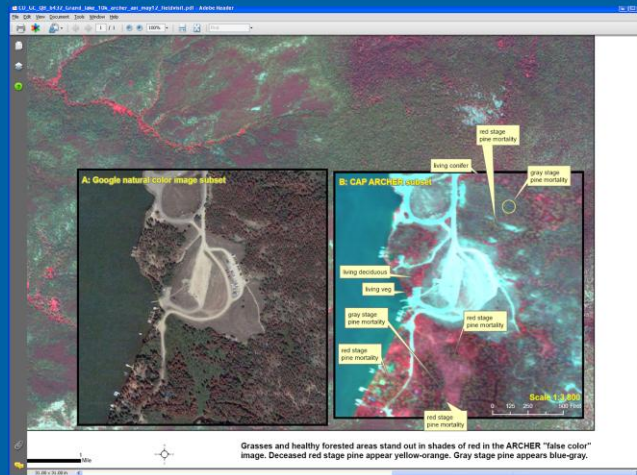
Screen shots received from CAP crew of the ARCHER system on board the aircraft.

Preliminary Classification



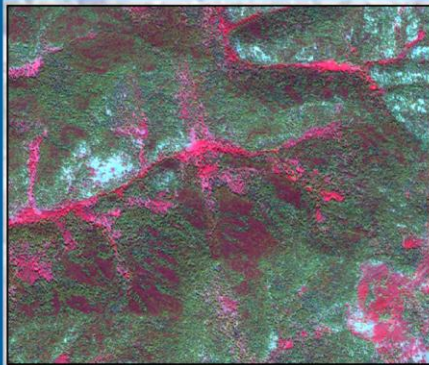
Examples of possible oil staining, processing completed by Susan Stitt (USGS/RMGSC) with the ITT ENVI software.

Grand County, CO Pine Beetle Infestation

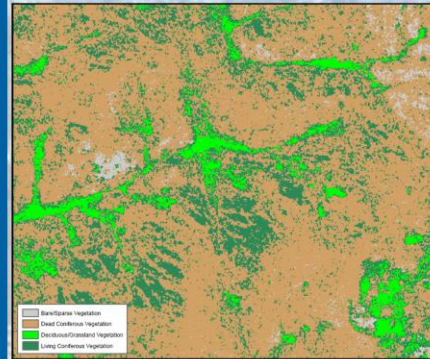


An infestation of pine beetles are decimating the pine forests of Colorado and much of the West. USGS was able to get the CAP to fly over parts of Grand County, Colorado to see if the spectral range of a hyperspectral sensor (52 bands as opposed to 4 bands in a multispectral sensor) could enable additional information to be detected.

Example – preliminary fine scale forest health analysis - QuickBird



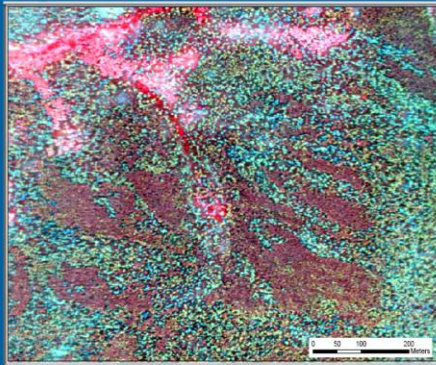
QuickBird Multispectral image, 2.4-meter spatial resolution



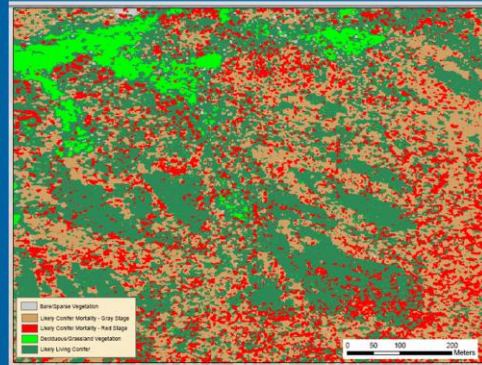
Preliminary generalized forest health classification using QuickBird imagery

On the left is a false color image of a portion of Grand County, CO. Lush vegetation is shown in various shades of red. The bright red are deciduous trees, the deep red are pine trees, and the “green” are dead trees. On the right is the same image with the classes identified.

Example – preliminary fine scale forest health analysis - ARCHER



CAP ARCHER Hyperspectral image, 1-meter spatial resolution

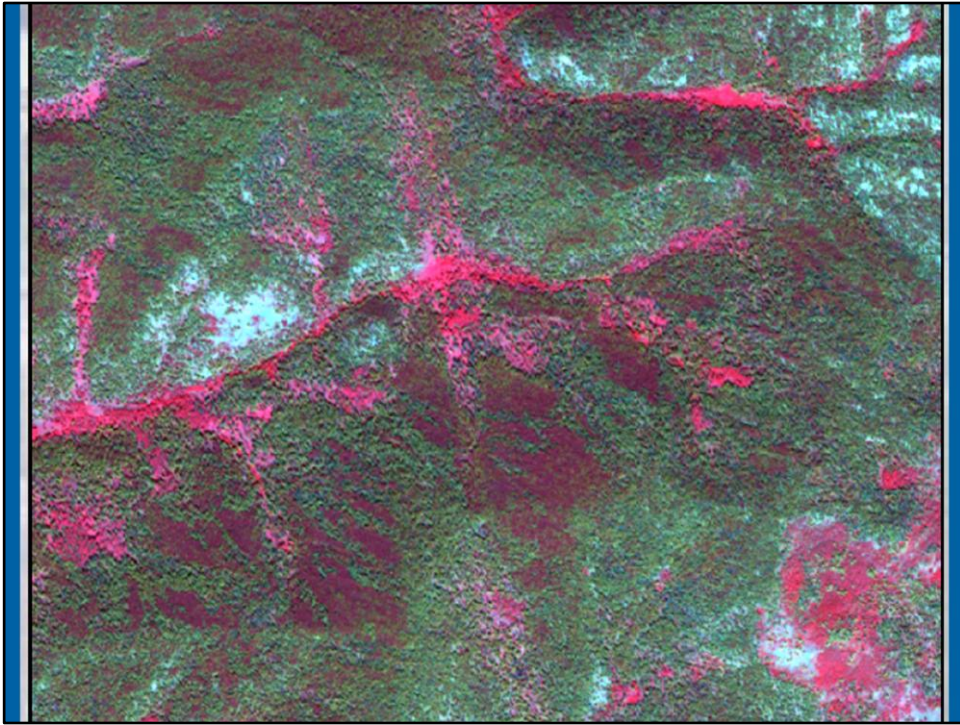


Preliminary generalized forest health classification using CAP ARCHER

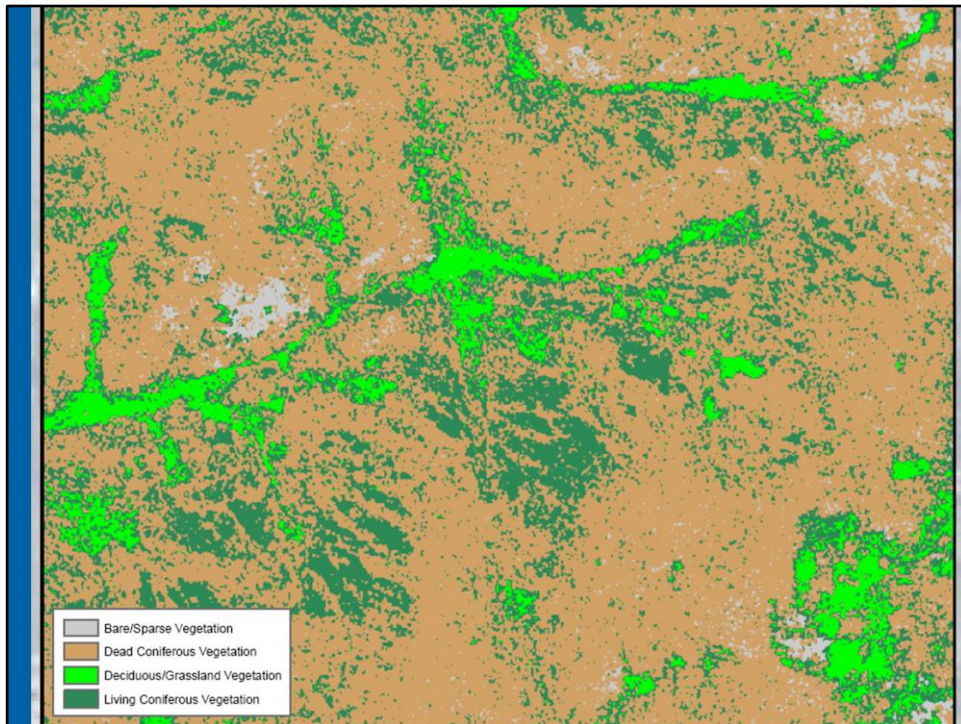


On the left is a false color image of a portion of Grand County, CO. Lush vegetation is shown in various shades of red. The bright red are deciduous trees, the deep red are pine trees, and the tan and cyan colors are dead and dying trees. On the right is the same image with the classes identified.

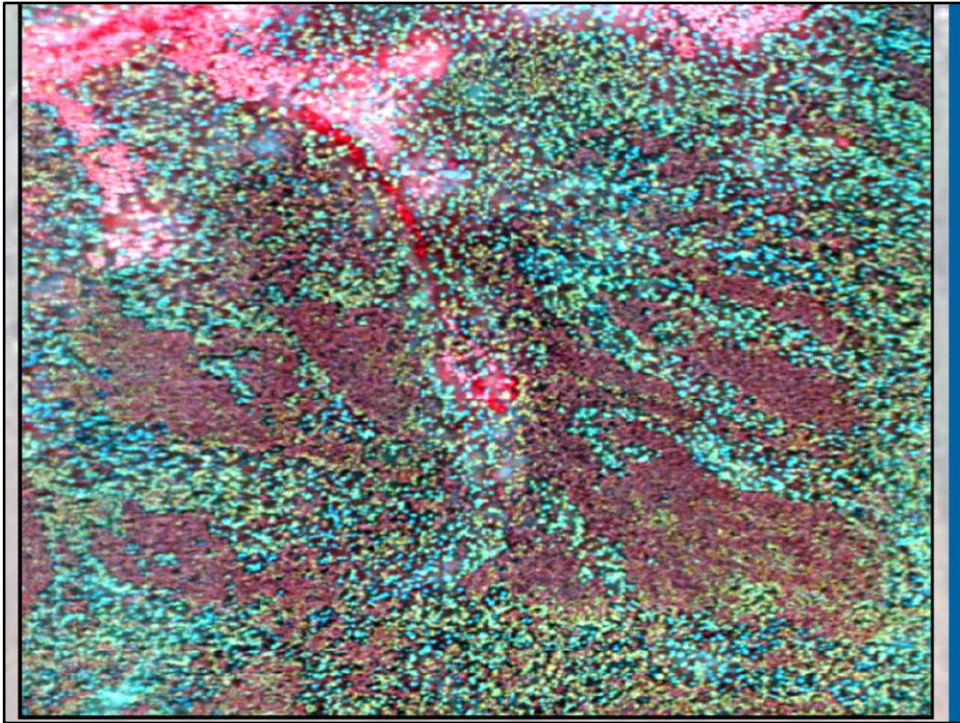
The added spectral range of the ARCHER HSI data enabled the researcher to detect both dead and dying (red stage) pines.



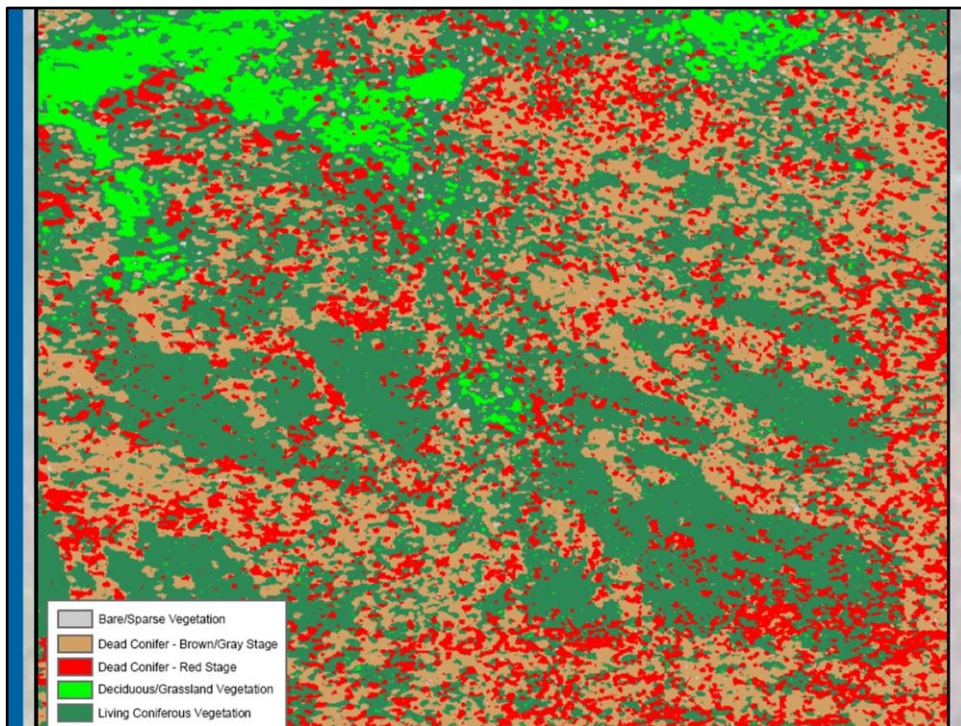
Enlargement of QuickBird false color image



QuickBird data classified into broad land cover classes.



Enlargement of ARCHER false color image



ARCHER imagery classified into broad land cover classes.